the former are often required in analysis. I do not think Shortrede's form of Gaussian logarithm convenient, and generally, I think, they would not be extensive enough.

I see little that could be done to the Table of Circular Functions. The extending it to the whole circle, and adding time arguments is a great convenience, and the only change I can think of as desirable is the extending the proportional parts for time, but the space seems to forbid.

The Table of Constants should be revised. With the change I have proposed in the running headings of the logs of numbers there would be no need for the columns $\frac{\sin}{\text{arc}}$ and $\frac{\tan}{\text{arc}}$. A great many of the constants might be dispensed with, and fifteen and thirteen places in the logs are quite needless. All the numbers should be carefully revised, and in selecting new ones I would avoid local numbers. Thus, gravity is given at Greenwich which is natural for an Englishman, though English physicists seem to refer now a great deal to Paris; but it would be preferable to give gravity at the Equator or Pole with the formula for correcting it, and the necessary logarithms. Many more constants and their logarithms could be added, even in one page, I think, if these changes were made. But the page should be much less crowded than at present, and the constants should be divided into groups, each with a conspicuous heading. Lastly, a few pages of good paper, for constants required by the owner in his pursuits, might be added with advantage.

I have long thought that 10-figure logarithms were wanted, both of numbers and circular functions; but I see no chance of such tables paying, for many a long day. They would only be used in particular cases.

I think in all computations where they are required it is impossible for a computer not to feel the enormous disadvantage of our mode of dividing the day and the circle. I have a strong feeling myself that the day and the circumference would be most conveniently decimally divided. I would make the difference of successive arguments in the Table of Circular Functions $\frac{1}{1000000}$ of the circumference. Ordinary men and their calculations would not be affected, and perhaps by the time they have advanced to 10-figure tables they will have got to appreciate decimal division. It would be easy to use the MS. French Tables to compare with any published on this system.

Note on observing Lunar Zenith-Distances for Longitude.

By Colonel Tennant.

The only rules I have ever seen for observing lunar zenith-distances for longitude are, first, that given by the Astronomer

Royal to the officers who were appointed to the North American Boundary Survey, which is about 6^h sidereal time, and for which he gives no reason; and secondly, that by M. Chauvenet, who says the Moon should be in the prime vertical. This is, I believe, wrong, nor does the Astronomer Royal's rule always answer.

If we suppose a perpendicular let fall from the zenith on to the great circle defining the lunar orbit, it will meet it in a point which (from analogy) I shall call the *nonagesimal of the lunar orbit.* The nonagesimal bisects that part of the orbit above the horizon, and is the highest point in it.

Since we know the time, and compute the Moon's altitude on the hypothesis of an assumed longitude, what we want to know is not the Moon's hour-angle at the moment of observation, but the amount by which her altitude is changed by error of longitude assumed, which changes her place in her orbit. When the orbit coincides with the vertical circle, this change is greatest, *ceteris paribus*, and in all other cases the less the inclination of the vertical to the orbit the greater the effect of change of place on the altitude.

If the station of observation have a latitude less than the greatest declination of the Moon in that lunation, then there are two sidereal times when the Moon's orbit passes through the zenith, and these will be found without difficulty by finding the right ascensions of the Moon when her declination equals the latitude.

At any other time the zenith distance of the nonagesimal will be the least inclination of the orbit to the vertical, and it measures this amount at the point of the orbit which is in the horizon, and whose distance both from nonagesimal and zenith is $90°$.

If the latitude be beyond the limits of the Moon's declination, then the least of all the possible inclinations is when the orbit is perpendicular to the meridian, which is when the sidereal time $= 6^h +$ A.R. ☊ of ☽'s orbit on equator.

When the orbit from any cause cannot pass through the zenith, the Moon should be low during observation. When it does, the zenith distance is immaterial. If the sidereal time be earlier than the best time by the last paragraph, then the zenith distance of the nonagesimal of the Moon's orbit is decreasing, and the best time would be evidently *after* she has risen. If there be a choice, she should be therefore observed in the east. If the sidereal time be later, she should be observed in the west, but the zenith distance should not in any case be small.

It is possible, of course, to give a formula by which the theoretically best sidereal time shall be got for any given position of the Moon and her orbit, but I do not think this would be of any practical use.

There is a practical point in Chauvenet's book which I wish could be remedied. In it, as in all investigations I have seen, the equation of condition for eclipses and occultations, &c. contains a

term involving the error of eccentricity of the terrestrial meridian. I need hardly say that the amount of doubt on this point is so small now that such observation could not be affected. But there has of late years arisen a very serious doubt as to the accuracy of geometric latitudes deduced from the astronomical or observed values. I think it is generally believed that there is everywhere some deflection of the plumb-line from the place it would have were the Earth constituted by law, and that in many places this amount is of importance.

We have no means of determining an absolute amount of meridian deflection, or a real geocentric latitude, except by the changes which the use of a wrong one produces in the resulting places of the Moon. I have before called attention to this (*Monthly Notices*, xvii. 62, paras. 14-15), and I would now propose that in a new edition of Chauvenet, or in any new work, the useless equation should be omitted, and that in lieu should be given two; one for the correction to the geometric latitude, and the other for a correction to the calculated radius vector of the Earth, which I have also shown (*Monthly Notices*, xvii. 236), may in some cases be sensibly affected.

Errors and Omissions in the Catalogue of Sir William Herschel's Double-Stars. By S. W. Burnham.

In the preparation of a general catalogue of double-stars I have had occasion to examine carefully Sir John Herschel's catalogue of his father's double-stars (*Memoirs of the Royal Astronomical Society*, vol. xxxv.), in connexion with various other catalogues, and in so doing have detected some errors, a record of which may be of service to double-star observers.

Sir John Herschel has undertaken to give in the column of "Synonyms and Remarks," the corresponding number of the double-star where it is found in the catalogues of Struve (*Mensuræ Micrometricæ*); Herschel and South (*Phil. Trans.* 1824); and South (*Phil. Trans.* 1826); but in many instances this has been overlooked. A number of them are also included in Sir John Herschel's own catalogues published in the various *Memoirs* of the Royal Astronomical Society.

Class I.

No. 13 (*Aquilæ* 136), *for* Σ 2541, *read* Σ 2525; and *for* S. 770, *read* S. 720.

36 (ξ *Herculis*), *add* Sh. 237.

48 This is identical with a double discovered by Alvan Clark in 1859, and heretofore regarded, by Dawes and others, as new. Herschel in 1783 made the angle 259°·8; Dawes in 1859 found it 246°·1; and it decreased by his measures about 2° in the seven years following (*Memoirs of the Royal Astronomical Society*, vol. xxxv. p. 468.) It is No. 103 of Chambers' *Catalogue of Binary Stars*.